

XT-9100 Technical Bulletin

XT-9100 Extension Module/XP-910x Expansion Modules	Page	3
• <i>Introduction</i>		3
• <i>SX Tool</i>		5
• <i>Model Codes</i>		5
• <i>Features</i>		5
Installation		7
• <i>XT-9100 Hardware Configurations</i>		7
• <i>Guidelines</i>		8
• <i>XP-9102 Hardware Settings</i>		9
• <i>XT-9100 Hardware Settings</i>		10
• <i>Installation Instructions</i>		10
• <i>Wiring</i>		11
Inputs/Outputs		15
• <i>Analog Inputs</i>		15
• <i>Digital Inputs</i>		15
• <i>Digital Counters</i>		16
• <i>Analog Outputs</i>		16
• <i>Digital Outputs</i>		17
Specifications		19
• <i>XT-9100-8004</i>		19
• <i>TR-9100-8001/8002</i>		19
• <i>XP-9102-8004</i>		20
• <i>XP-9103-8004</i>		21
• <i>XP-9104-8004</i>		21
• <i>XP-9105-8004</i>		22

- *XP-9106-8004*

22

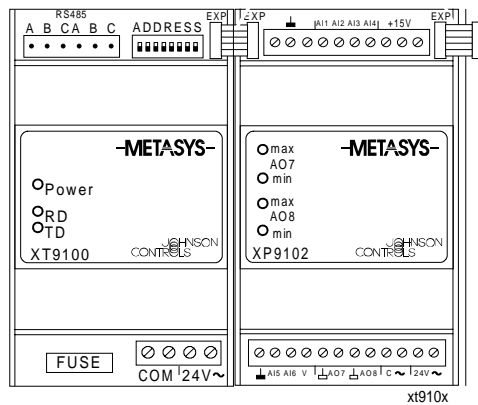
XT-9100 Extension Module/ XP-910x Expansion Modules

Introduction

The XT-9100 Extension Module and XP-910x Expansion Modules have been designed to provide additional input and output capacity within Metasys® Networks, specifically for the DX-9100 Extended Digital Plant Controller. The XT-9100 module provides the communications interface, and the XP modules provide the analog and digital inputs and outputs.

A Supervisory System communicates with the XT-9100 via the N2 Bus or Bus 91*. See Figure 2. Each XT-9100 can have up to 16 inputs/outputs, eight of which may be analog.

The DX-9100 communicates with the XT-9100 via the XT-Bus. When the DX-9100 is connected to the N2 Bus (or Bus 91), data from the XT-9100 is available to a Supervisory System. See Figure 3. Up to eight XT-9100 modules can be connected to the XT-Bus. Each XT provides, depending on the type of the connected XP expansion modules, eight analog or eight digital points, extending the input/output of a DX-9100 by up to 64 remote input/outputs. Modules with 16 input/outputs may also be connected, provided that the total number of remote input/output points on the DX-9100 does not exceed 64.



**Figure 1: XT-9100 Extension Module and
XP-910x Expansion Module**

* The term “Bus 91” is not used in North America.

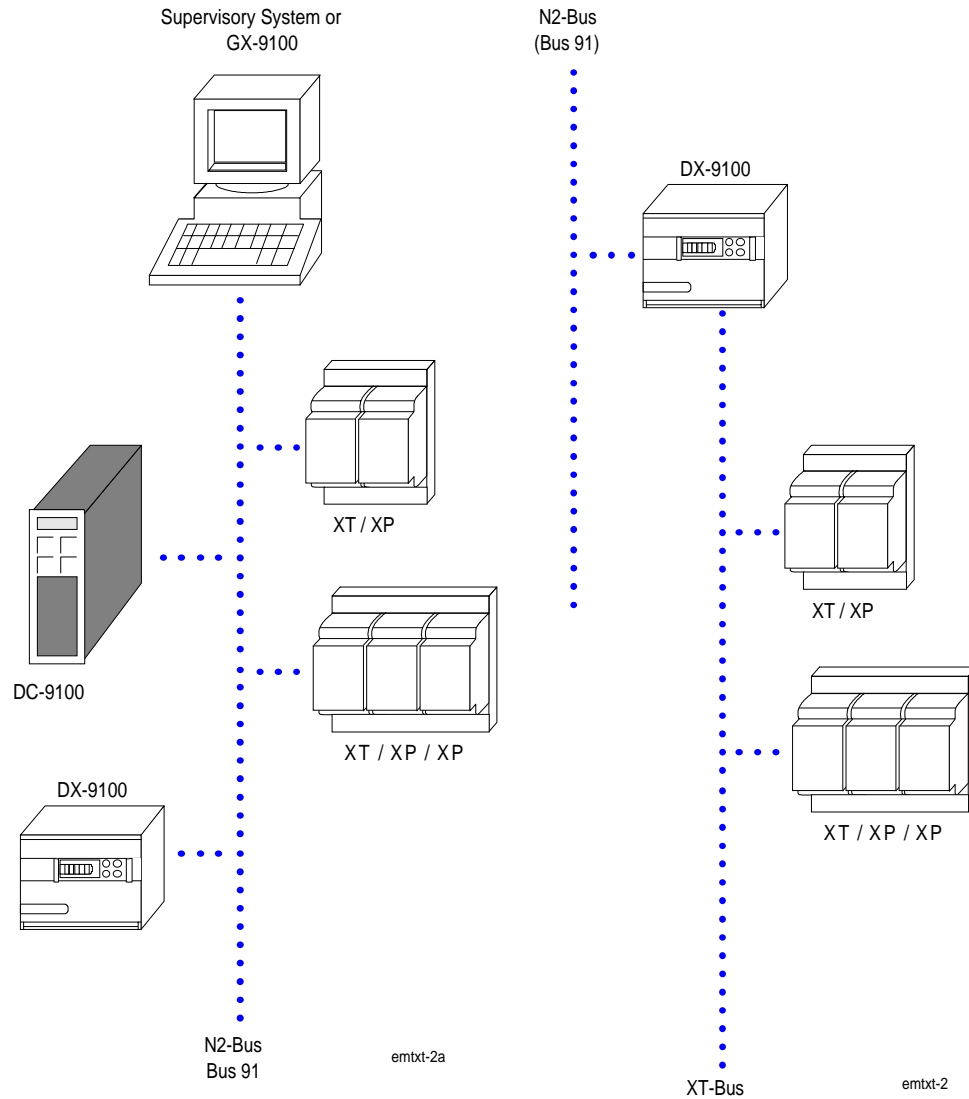


Figure 2: General Application

Figure 3: DX-9100 Application

Configuration of the XT-9100 is achieved by using a personal computer with GX-9100 Graphic Configuration Software supplied by Johnson Controls, or by downloading a previously uploaded configuration. Downloading takes place either directly over the serial interface or via the DX-9100 and XT-Bus.

SX Tool

The XT-9100 may also be configured, item by item, using an SX-9100 Service Module (SX Tool) connected to the DX-9100 Controller.

Model Codes

Table 1: XT/XP/TR Model Codes

XT-9100	Extension Module	24 VAC supply
XP-9102	Expansion Module	6 analog inputs 2 analog outputs
XP-9103	Expansion Module	8 digital outputs (triacs)
XP-9104	Expansion Module	4 digital inputs 4 digital outputs (triacs)
XP-9105	Expansion Module	8 digital inputs
XP-9106	Expansion Module	4 digital outputs (relay)
TR-9100*	Transformer, 9 VA	Primary: 220 or 240 VAC Secondary: 24 VAC

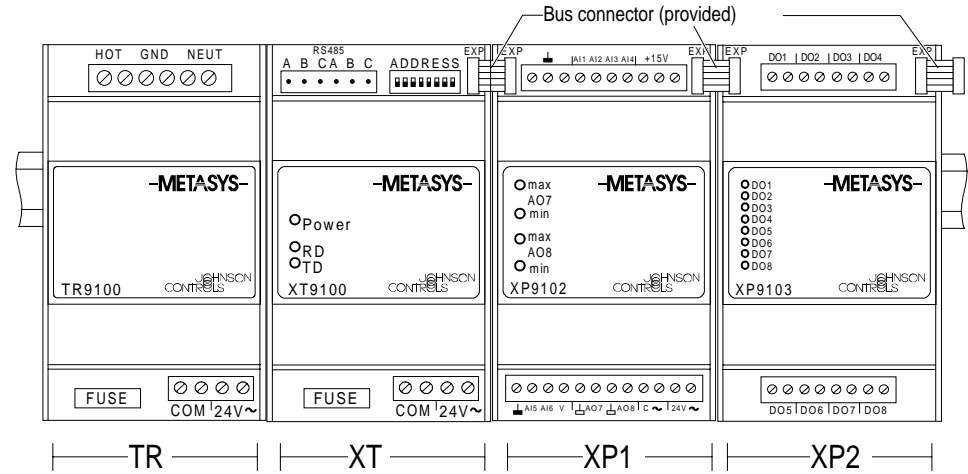
* TR-9100 is not available in North America.

Features

- Range of I/O submodules (XPs) for flexible configuration of 4, 8, 12, or 16 data points
- Analog inputs 0 to 10V, 0/4 to 20 mA, or RTD
- Analog outputs 0 to 10V, or 4 to 20 mA
- Digital inputs with digital counter option
- Digital outputs; triacs or relay contacts
- I/O data point configurable by using GX-9100 Graphic Configuration Software
- Communications bus (RS-485) for Supervisory System
- LED status indicators
- Transformer module for 220 or 240 VAC supply
- Enclosure material of self-extinguishing ABS
- DIN rail mounting

Installation

XT-9100 Hardware Configurations



emtxt-4

Figure 4: Typical XT-9100 Configuration

Table 2: XT Configurations

TR	Transformer	TR-91000-8001/8002 (not available in North America)	(optional)
XT	Processor	XT-9100-8004	
XP1	Analog or Digital	XP-9102-8004 XP-9103-8004 XP-9104-8004 XP-9105-8004 1 or 2 x XP-9106-8004	(See Note 1.) (See Note 2.)
XP2	Digital	XP-9103-8004 XP-9104-8004 XP-9105-8004 1 or 2 x XP-9106-8004	(optional) (optional) (optional) (optional) (See Notes 2 and 3.)

Notes:

1. Analog XPs must be placed in position XP1.
2. Two XP-9106 modules are considered as one XP module when installed next to each other in Position XP1 or XP2. When a single XP-9106 is installed in Position XP1 and another type of XP module is installed in XP2, the total number of I/Os is restricted to 12.
3. The XP-9106 can only be placed in Position XP2 when Position XP1 is filled by an analog XP or two XP-9106 modules.

Guidelines

While every reasonable precaution has been taken to prevent electrical disturbances from adversely affecting the operation of modules, lack of attention to generally accepted control wiring installation practices can lead to module problems in high electromagnetic field environments. In general, follow the guidelines below.

- Do not mount the modules in heavy-duty switch gear cabinets or in cabinets with frequency converting or phase-cutting equipment.
- Low-voltage wiring in electrical cabinets must be physically separated from line-voltage and power wiring, and a distinctive color (e.g., white or pink) is recommended.
- To avoid electrical interference in field cables:
 - Keep input and output point cable runs as short as possible (<160 ft; 50 m).
 - Use twisted pair cables.
 - Run low-voltage cables separately from line-voltage/power cables. Maintain a minimum separation of >12 in (30 cm) for 220V, 30A circuits.
 - Do not run low-voltage cables parallel to power cables for long distances (>10 ft; 3 m).
 - Do not run cables close to transformers or high frequency generating equipment.
 - In high electromagnetic field environments, use shielded cable, grounding the shield at one end, preferably to the modules cabinet only.
 - For communication Bus 91 (N2 Bus) and Extension Module bus (XT-Bus) use a cable recommended for RS-485 transmission. The cable must be shielded and grounded at one end only. (See the technical bulletin on Metasys N2 Bus or System 91 Bus Converter and Repeater.)
- If a TR-9100 transformer is used for the XT-9100 and the XPs, an additional supply should be used for the external devices. Do not connect switched inductive loads to the 24V transformer that supplies the modules, and cable each connected load from the transformer separately.

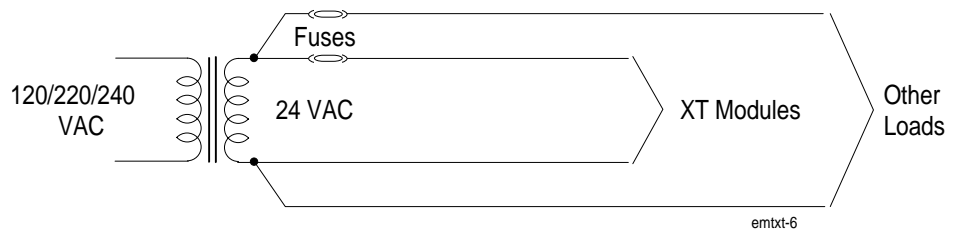


Figure 5: Wiring of Module to a 24V Transformer

XP-9102 Hardware Settings

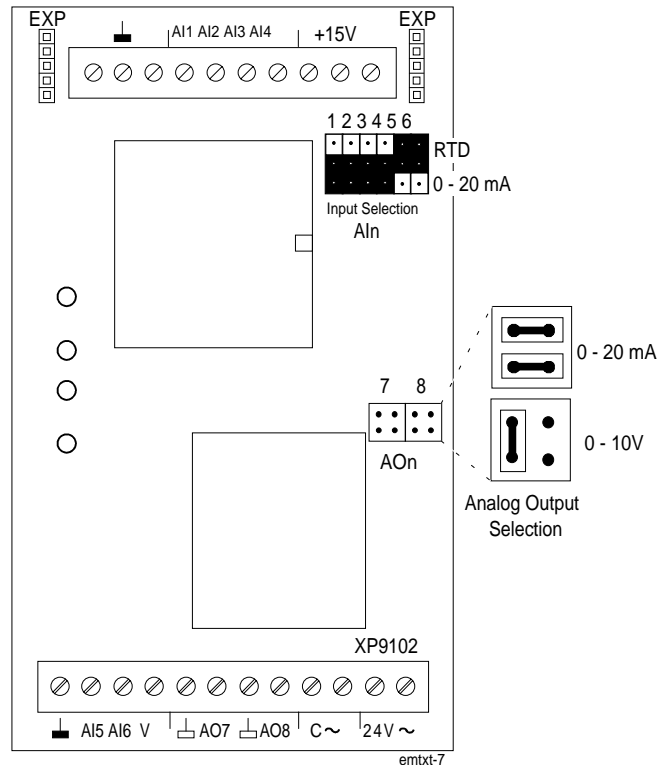


Figure 6: Jumper Details for the XP-9102

All jumper selections must be made *before* installing the module and *before* power is applied to the module.

Remove the cover of the module and select the **Analog Input Type** using *one* jumper per input in the respective position RTD or 0 to 20 mA inputs. Remove the jumper completely to select 0 to 10V.

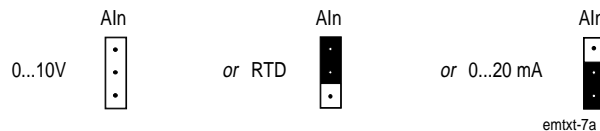


Figure 7: More Jumper Details

A maximum of 30 mA is available from the 15V supply of the module.

Select **Analog Output Type** using the jumpers as shown above. Two jumpers are required for 0 to 20 mA and one jumper for 0 to 10V output.

XT-9100 Hardware Settings

Select **Module Address** (for the Supervisory System) on the address switches in 8-bit binary format. An address of 0 is not permitted on the XT-Bus.

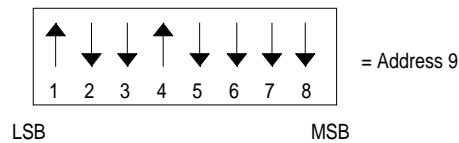
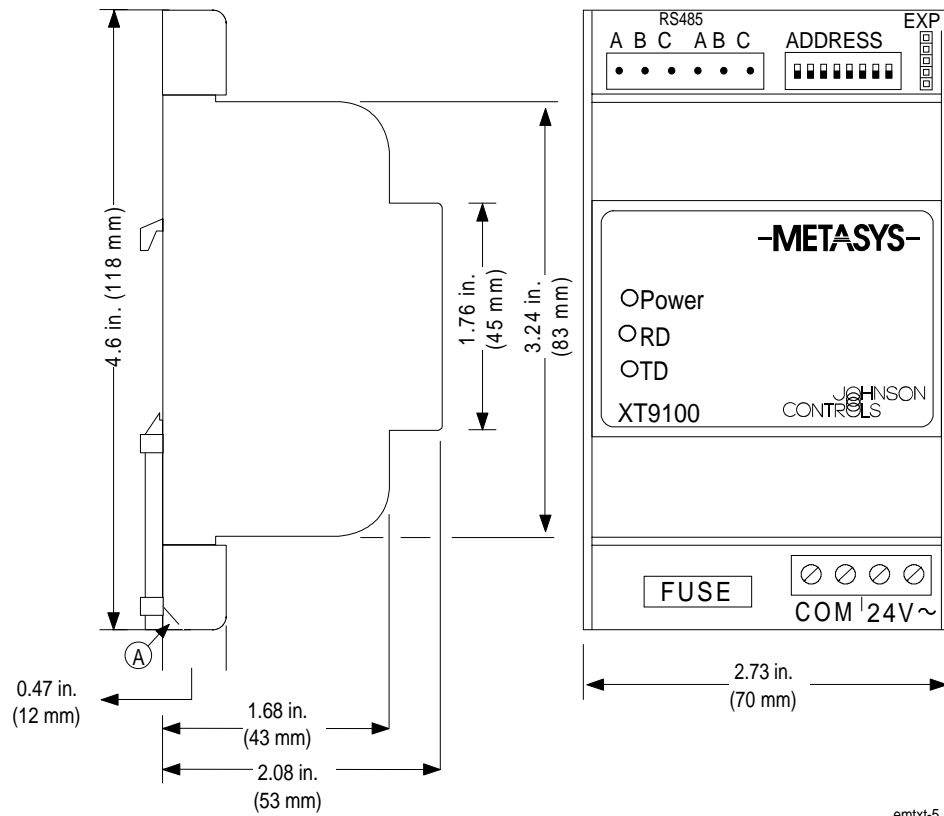


Figure 8: Hardware Settings

Installation Instructions



emtxt-5

Figure 9: Module Dimensions

1. Snap the module onto the 1 3/8 inch (35 mm) DIN rail. To release the module, insert a screwdriver at the base of the module (Point A) to release the retaining clip and pull forward.
2. Wiring:
 - a) Terminations are made via the terminal blocks on the upper and lower parts of the modules that accept 14 AWG (1 x 1.5 mm²) cable. See Figures 10 to 16 for details.

- b) Terminations of the serial link bus cable are via the connectors provided with the XT-9100 module.
- c) Interconnections between XT and XP modules for the extension bus are via the connector cables provided with each module.
- d) Complete all wiring and connections to the XT and XP modules before applying power. The XT processor will then automatically configure itself for the connected XPs.



CAUTION: The CMOS integrated circuits in the modules are sensitive to static. Take suitable precautions.

Wiring

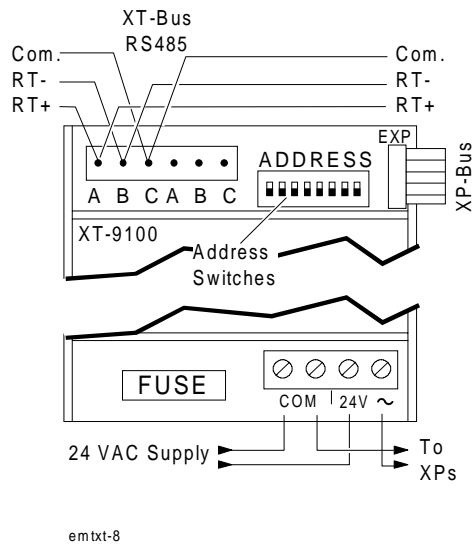


Figure 10: XT-9100

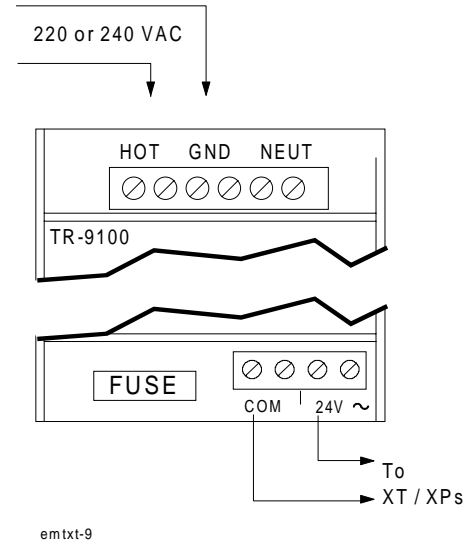


Figure 11: TR-9100

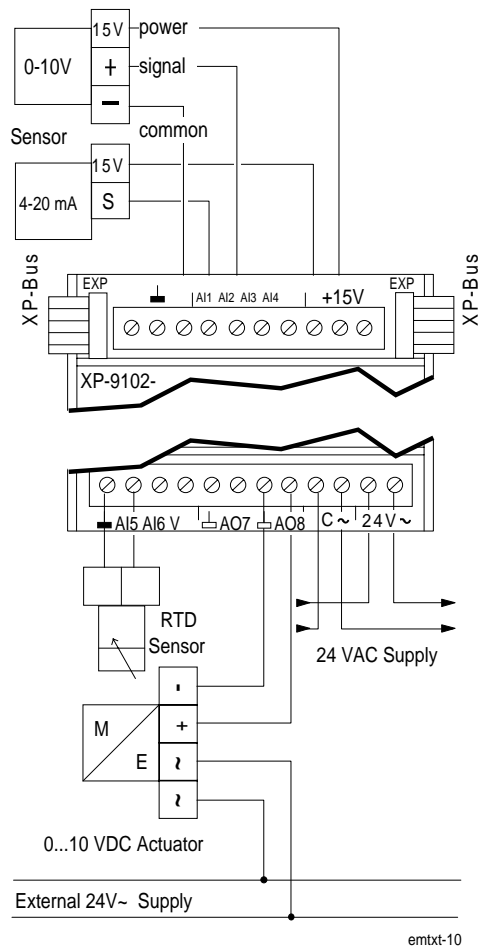


Figure 12: XP-9102

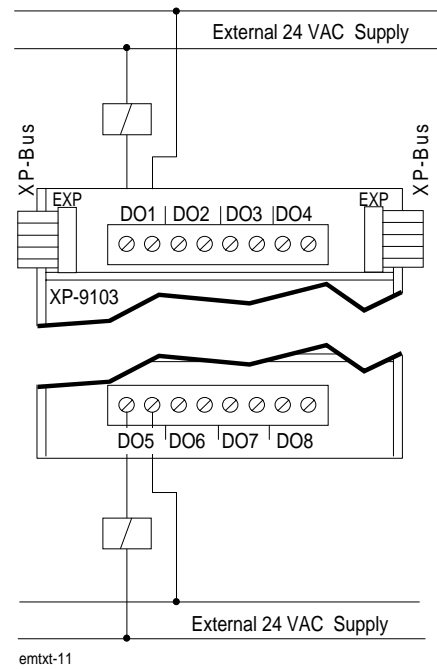


Figure 13: XP-9103

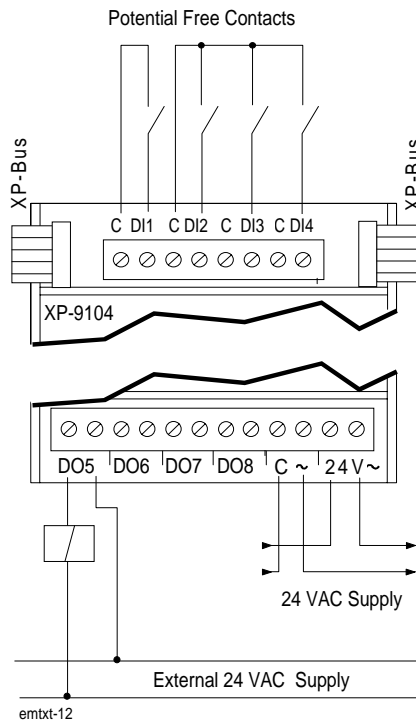


Figure 14: XP-9104

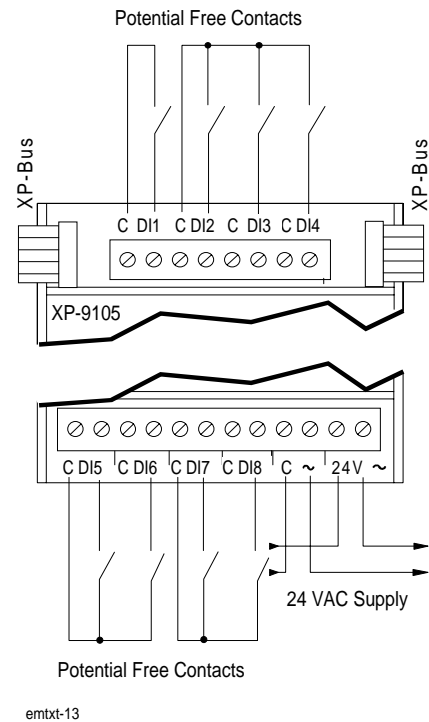


Figure 15: XP-9105

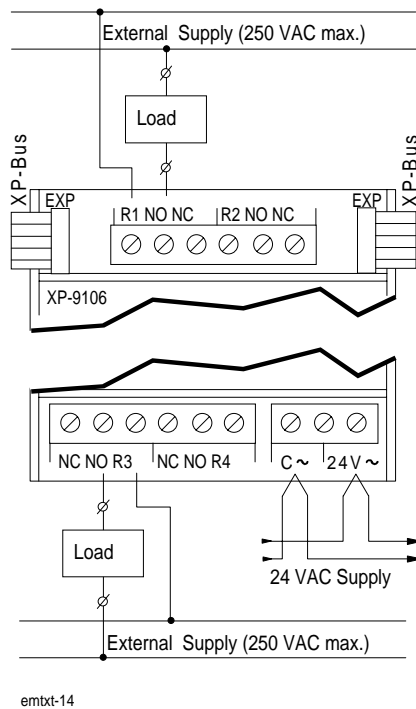


Figure 16: XP-9106

Legend

Aln	Analog input signal
AOn	Analog input common
AOon	Analog output signal
AOon	Analog output common
DIn	Digital input
C	Digital input common
DOn	Digital output (triac)
C~	24 VAC common
Rn	Relay output common
NO	Normally open contact
NC	Normally closed contact

xtlegend

Notes:

1. Loads connected to digital outputs should be supplied from a separate, properly sized transformer and not from the TR-9100 transformer.
2. The following commons are electrically independent:
 - Analog Input Common (for AI1 to 6)
 - Analog Output Common (for AO7 and 8)
 - 24V Common/Digital Input Common (for DI1 to 8)
 - Communications Common (N2 Bus/XT-Bus)

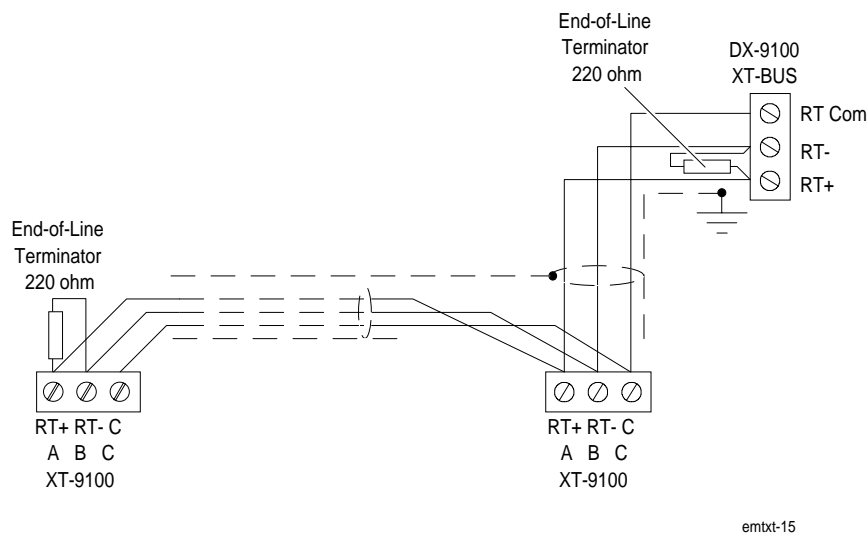


Figure 17: Connection Details for the XT-Bus

**XT-Bus
Guidelines:**

1. Maximum: 8 x XT-9100 per DX-9100
2. Maximum bus length: 4,000 ft (1200 meters)
3. When the bus length is greater than 330 ft (100 meters), install 220 ohm end-of-line resistors at each end of the XT-Bus line. When the bus length is less than 330 ft (100 meters), install a 220 ohm end-of-line resistor at the DX-9100 only.

Inputs/Outputs

Analog Inputs

Expansion modules with analog inputs accept 0 to 10V, 0 to 20 mA, or passive RTD sensors by jumper configuration. For 0 to 20 mA DC inputs, a zero offset to 4 mA may be set by software configuration. The measurement unit of each input can be configured for degrees Celsius, degrees Fahrenheit, or no unit. Voltage and current inputs can be ranged using the programmable range parameters as follows:

Lower end of range (LR) for 0V/ 0 mA/ 4 mA

Higher end of range (HR) for 10V/ 20 mA

Voltage and current inputs can be linearized by a square root function that operates over the complete range of the input:

$$AI = [\text{sqrt}(\text{PR}\%/100)] \times (\text{HR} - \text{LR}) + \text{LR}$$

Where PR% = the analog value in percent of the physical range (0 to 10V, 0 to 20 mA, 4 to 20 mA).

A configurable filter is incorporated for the reduction of signal instability.

In addition, expansion modules with analog inputs will accept Ni1000, Pt1000, Ni1000 Landis & Gyr, and A99 passive RTD sensors. For these sensors, the measurement range is fixed for each input type.

Expansion modules with analog inputs provide the 15 VDC supply for the analog input sensors. The maximum current supplied from this power supply must not exceed 30 mA.

A high and low alarm limit setting can be assigned to each of the analog inputs.

When connected to a DX-9100 Controller, each analog input value and percentage of full range can be assigned to any of the 12 programmable function modules, and high and low alarms are available as logic variables.

Digital Inputs

Expansion modules with digital inputs are powered by an external 24 VAC source. A digital input is active when connected to the digital input common via an external potential-free contact.

A digital input may be defined as maintained or pulse type by configuration. With maintained type contacts, the extension module status follows the status of the contact. With pulse type contacts, the extension module sets and resets the status at each pulse of the input contact.

When connected to a DX-9100 Controller, each of the digital inputs can be assigned to any of its 12 programmable function modules, or to its programmed logic control module.

The status of each input on a digital expansion module is indicated by an LED.

Digital Counters

Digital counters are available for the first expansion module (XP1) when it does not have analog inputs or outputs. Digital counters are associated with digital inputs. The number of transitions of the physical digital input required to increment the counter can be programmed in the extension module. The maximum value of each counter is 9,999,999.

Analog Outputs

Expansion modules with analog outputs provide 0 to 10V or 0 to 20 mA outputs by jumper configuration (see Figure 6), and a 4 mA zero offset by software configuration.

Each output level is indicated by two LEDs, one for 0% and one for 100%. The LEDs are equally bright at 50% output. Analog outputs have a fixed range of 0 to 100% in the expansion module.

When connected to a DX-9100 Controller, the outputs can be configured to the outputs of its programmable function modules. Each of the analog outputs can be ranged in the DX-9100 to give a 0 to 100% output between a High Range (HR) and Low Range (LR) value.

Each analog output module in the DX-9100 is therefore configurable with three parameters and can carry out the following functions:

For $LR < I < HR$, the Output = $[(I - LR) / (HR - LR)] \times 100\%$

For $I < LR$, the Output = 0%

For $I > HR$, the Output = 100%

where:

I = Input variable

LR = Low range variable corresponding to the module input value that requires the hardware output to be at 0%

HR = High range variable corresponding to the module input value that requires the hardware output to be at 100%

Digital Outputs

Expansion modules with digital outputs can be configured as on/off or pulse type. The physical output may be a triac or a relay contact.

When connected to a DX-9100 Controller, the digital outputs may be driven by any logic variable or output of the programmable function modules, programmable logic module, or time schedule modules.

Each digital output can be configured to provide one of the following output types:

- On/off

The triac or relay is switched on or off by a change-of-state of the logic variable in the DX-9100.

- Pulse

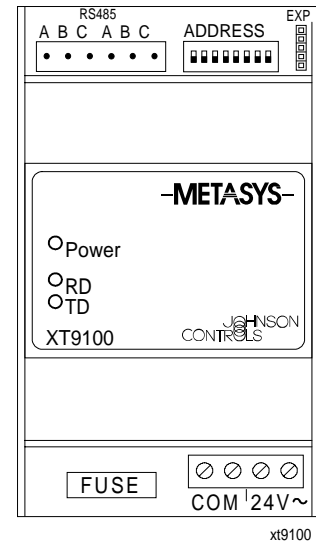
The triac or relay is switched on for a configurable period (0 to 1250 ms) for each state transition of the connected logic variable in the DX-9100.

The status of each output on a digital expansion module is indicated by an LED.

Specifications

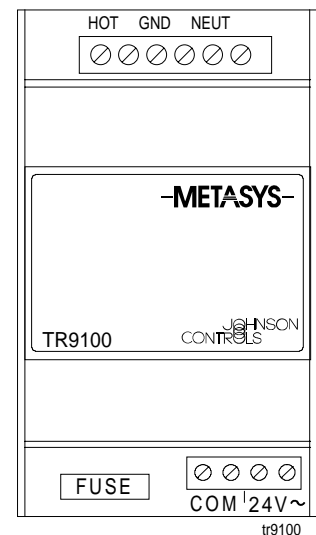
XT-9100-8004

Electrical Requirements	24 VAC +10% - 15%, 50/60 Hz
Power Consumption	5.5 VA
Terminations:	
Power Supply	14 AWG (1 x 1.5 mm ²) (max.) cable
Serial Interface	RS-485 cable
XP-BUS	Connector cable provided with XP
Serial Interface	RS-485; 9600 baud; opto-isolated
LED Indicators	Power On (Flashing = no communication) Receive Data Transmit Data
Operating Environment	+32 to 122°F (0 to +50°C) 10 to 90% RH, non-condensing
Storage Environment	-4 to 158°F (-20 to +70°C)



TR-9100*- 8001/8002

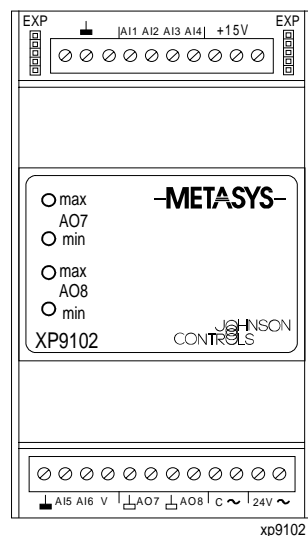
Electrical Requirements	220 or 240 VAC +/- 10%, 50/60 Hz
Electrical Output	24 VAC, 50/60 Hz
Power Capacity	Up to 14 VA
Terminations	14 AWG (1 x 1.5 mm ²) (max.) cable
Operating Environment	+32 to 122°F (0 to +50°C) 10 to 90% RH, non-condensing
Storage Environment	-4 to 158°F (-20 to +70°C)



* TR-9100 not available in North America.

XP-9102-8004

Electrical Requirements	24 VAC +10% - 15%, 50/60 Hz
Power Consumption	3 VA
Terminations:	
Inputs/Outputs	14 AWG (1 x 1.5 mm ²) (max.) cable
Power Supply	14 AWG (1 x 1.5 mm ²) (max.) cable
XP-BUS	Connector cable provided.
Analog Inputs	6 inputs, 10-bit resolution Inputs jumper selectable: <ul style="list-style-type: none"> • 0 to 10 VDC, >300K ohm impedance • 0/4 to 20 mA, 100 ohm impedance • RTD (Ni1000, Pt1000, A99)
Analog Outputs	2 outputs, jumper selectable: <ul style="list-style-type: none"> • 0 to 10 VDC, (10 mA) • 0/4 to 20 mA, max. 500 ohm
LED Indicators	Each output level indicated by two LEDs, one for 0% and one for 100%. The LEDs are equally bright at 50% output.
Active Sensor Supply	15 VDC, 30 mA
Operating Environment	+32 to 122°F (0 to +50°C) 10 to 90% RH, non-condensing
Storage Environment	-4 to 158°F (-20 to +70°C)



XP-9103-8004

Electrical Requirements

Powered from XT-9100

Terminations:

Outputs

14 AWG (1 x 1.5 mm²) (max.) cable

XP-BUS

Connector cable provided.

Digital Outputs

8 triac outputs, 500 mA RMS,

On/Off or Pulse Type

LED Indicators

Each output indicated by an LED.

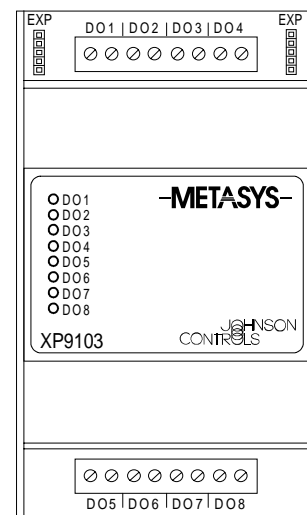
Operating Environment

+32 to 122°F (0 to +50°C)

10 to 90% RH, non-condensing

Storage Environment

-4 to 158°F (-20 to +70°C)



XP-9104-8004

Electrical Requirements

24 VAC +10% - 15%, 50/60 Hz

Power Consumption

0.5 VA

Terminations:

Inputs/Outputs

14 AWG (1 x 1.5 mm²) (max.) cable

Power Supply

14 AWG (1 x 1.5 mm²) (max.) cable

XP-BUS

Connector cable provided.

Digital Input

4 digital inputs from potential-free contacts,

Maintained or Pulse Type

Digital Outputs

4 triac outputs, 500 mA RMS,

On/Off or Pulse Type

LED Indicators

Each input indicated by an LED.

Each output indicated by an LED.

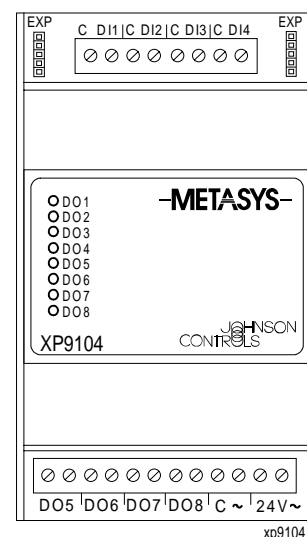
Operating Environment

+32 to 122°F (0 to +50°C)

10 to 90% RH, non-condensing

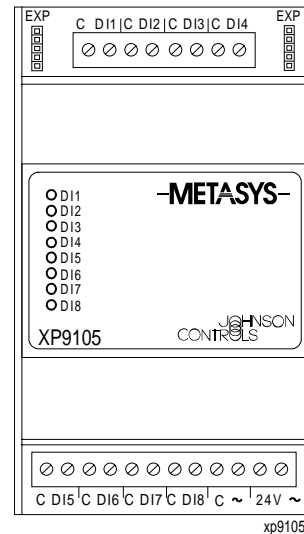
Storage Environment

-4 to 158°F (-20 to +70°C)



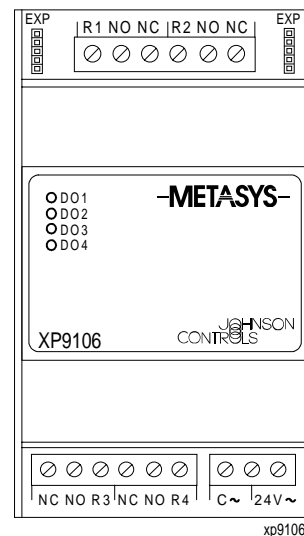
XP-9105-8004

Electrical Requirements	24 VAC +10% - 15%, 50/60 Hz
Power Consumption	1 VA
Terminations:	
Inputs	14 AWG (1 x 1.5 mm ²) (max.) cable
Power Supply	14 AWG (1 x 1.5 mm ²) (max.) cable
XP-BUS	Connector cable provided.
Digital Input	8 digital inputs from potential-free contacts, Maintained or Pulse Type Transition counter function; max. 50 Hz
LED Indicators	Each input indicated by an LED.
Operating Environment	+32 to 122°F (0 to +50°C) 10 to 90% RH, non-condensing
Storage Environment	-4 to 158°F (-20 to +70°C)



XP-9106-8004

Electrical Requirements	24 VAC +10% - 15%, 50/60 Hz
Power Consumption	4 VA
Terminations:	
Outputs	14 AWG (1 x 1.5 mm ²) (max.) cable
Power Supply	14 AWG (1 x 1.5 mm ²) (max.) cable
XP-BUS	Connector cable provided.
Digital Outputs	4 relay outputs, SPDT relay 250 VAC/5 Ampere On/Off or Pulse Type
LED Indicators	Each output indicated by an LED.
Operating Environment	+32 to 122°F (0 to +50°C) 10 to 90% RH, non-condensing
Storage Environment	-4 to 158°F (-20 to +70°C)



Notes

Notes



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